

0.010%". According to the Examiner, "Prengaman teaches a lead alloy comprising tin, aluminum, barium, calcium and silver...". However, Applicant can find nothing in the Prengamen patent which discloses the use of "barium" in any quantities.

Based upon the Examiner's analysis, it would have been obvious to one of ordinary skill in the art to increase the silver content of the Albert barium alloy, in accordance with the Prengaman patent, in order to improve corrosion resistance. Applicant respectfully contends that it would not be obvious to one of ordinary skill in the art to obtain the synergistic unexpected benefits of corrosion resistance of lead alloys obtained with a composition range of 0.010 to 0.017 wt% of barium and 0.006 to 0.010 wt% of silver, as described in the original specification. Applicant respectfully refers to the illustrations of Figures 2 and 3 associated with the original specification so as to demonstrate empirically the unexpected benefits associated with the barium and silver range compositions of the present invention. The benefits of these synergistic effects of silver and barium in the stated composition were particularly illustrated in the empirical test results of the original specification. In particular, on page 12, lines 11 - 19, it was stated that:

The results of overcharge corrosion resistance for three different alloys are shown in Fig 2., plotting the grid weight losses per unit of area of the tested grid versus the type of alloy. The alloys tested were: Pb-Ca-Sn-Al-Ag alloy ( 0.045% Ca, 0.92% Sn, 0.0125%Ag, 0.0130%Al), Pb-Ca-Sn-Al-Ba alloy ( 0.051% Ca, 1.03%Sn, 0.019%Al, 0.013%Ba ) and Pb-Ca-Sn-Al-Ag-Ba alloy (0.052% Ca, 1.03% Sn, 0.0095%Ag, 0.017%Al, 0.016%Ba ), according to the present invention. Evidence from these results has shown that the corrosion of battery grids is reduced, in comparison to Pb-Ca-Sn-Al-Ag and Pb-Ca-Sn-Al-Ba alloys, when the grids are made with Pb-Ca-Sn-Al-Ag-Ba alloys according to the present invention.

Additionally, on page 13, lines 6 - 14, it was also stated that:

The alloys tested were: Pb-Ca-Sn-Al-Ag alloy ( 0.045% Ca, 0.92% Sn, 0.0125%Ag, 0.0130%Al) represented by line 32 of Fig. 3; Pb-Ca-Sn-Al-Ba alloy ( 0.051% Ca, 1.03%Sn, 0.019%Al, 0.013%Ba) represented by line 31 of Fig. 3 and Pb-Ca-Sn-Al-Ag-Ba alloy ( 0.052% Ca, 1.03% Sn, 0.0095%Ag, 0.017%Al, 0.016%Ba) represented by line 30 of Fig. 3, according to the present invention. Evidence from results shown in Fig 3 has confirmed the overcharge corrosion resistance results presented in Fig. 2 of the present application. The corrosion of battery grids is reduced, in comparison to Pb-Ca-Sn-Al-Ag and Pb-Ca-Sn-Al-Ba alloys, when the grids are made with Pb-Ca-Sn-Al-Ag-Ba alloys according to the present invention.

Furthermore, field tests conducted upon the composition of the present invention confirmed these unexpected findings. As was stated on page 13, lines 17 - 22 through page 14, lines 1 - 10:

Batteries assembled with Pb-Ca-Sn-Al-Ba (0.051 %Ca, 1.03%Sn, 0.019 %Al, 0.013%Ba) alloy grids were mounted in a fleet of 30 taxis in order to perform a real life performance evaluation of said alloy. Taxis provide an acceleration factor for rapid evaluation of the alloy. Another fleet of 30 taxis was fitted with batteries assembled with the standard Pb-Ca-Sn-Al-Ag (0.045%Ca, 0.92% Sn, 0.0125%Ag, 0.0130%Al) alloy commonly utilized in the products of the applicant, which does not contain barium. A third fleet of 30 taxis was fitted with batteries assembled with Pb-Ca-Sn-Al-Ag-Ba (0.052%Ca, 1.03%Sn, 0.0095%Ag, 0.017%Al, 0.0160%Ba) alloy grids to evaluate the performance of lead alloys containing both silver and barium. The batteries of the three fleets were maintained in service for about 15 months and were subsequently analyzed in the laboratory having shown a significant difference in corrosion level. 55 % of batteries assembled with Pb-Ca-Sn-Al-Ba alloy grids failed during this period. During the same period, 48 % of the batteries assembled with Pb-Ca-Sn-Al-Ag-Ba alloy and 41% of the batteries assembled with Pb-Ca-Sn-Al-Ag alloy failed. The most common failure mode of the batteries in these field tests was due to grid growth. The grid growth which is termed creep corrosion leads to electrical shorting of the cell elements, when the grid of the positive plates raises and reaches the underneath of the strap of the negative plates causing an internal electrical short in the battery.

Fundamentally, one of ordinary skill in the art would expect a corrosion resistance performance of the Pb-Ca-Sn-Al-Ag-Ba alloy to be between the corrosion resistance performance of the Pb-Ca-Sn-Al-Ba alloy and the corrosion resistance performance of the Pb-Ca-Sn-Al-Ag alloy. However, one of ordinary skill in the art would not the unexpected superior synergistic corrosion resistance performance empirically found during the testing associated with the composition of the present invention. Applicant respectfully contends the synergistic benefits obtained by the lead alloy within the narrow range of silver and barium content, as in the present invention, is neither shown in the prior art nor made obvious to one of ordinary skill in art at the time that the invention was made.

It is important to realize that the superior synergistic effects of the barium and silver components compositions of the lead alloy of the present invention relative to corrosion resistance performance are obtained in a narrower range of silver and barium than that stated by Albert and Prengaman publications independently. For example, in the original specification it was demonstrated that silver contents of lower than 0.006 wt% resulted in an insufficient corrosion resistance. On the other hand, silver contents of greater than 0.010 wt% resulted in poor mechanical properties of the alloy. Applicant refers to the remarks in the previous Amendment "A" and the previous Response "B". Such comments and remarks are incorporated herein by reference.

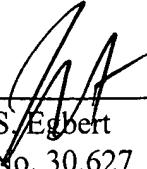
Based upon the foregoing analysis, Applicant contends that independent Claims 4 and 5 are in proper condition for allowance. Reconsideration of the rejections, in light of the foregoing

present remarks, is respectfully requested. Since no new claims have been added above those originally paid for, no additional fee is required.

Respectfully submitted,

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Date

  
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